Know-how in a low tech company: chances for being competitive in a globalized economy

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Preprint / Preprint
Arbeitspapier / working paper

Zur Verfügung gestellt in Kooperation mit / provided in cooperation with:
SSG Sozialwissenschaften, USB Köln

Abstract

This paper focuses on the overall background for the present discussion within advanced industrialized countries on the future for low-tech industries and the restructuring within or from them. Three partly interrelated phenomena on the macro level are analysed: the globalization process, the international high-tech competition and the long term escape from industrial activity towards a “post-industrial” society and economy.
The conventional wisdom provided by these macro-level phenomena on the strength of the structural change ahead of us are, however, challenged in three ways: stylized facts show large differences in performance indicating vast potentials for industrial creativity also where you would not expect them; there is among economists a growing interest on the creative and innovative aspects of industrial activities, thus providing new tools for the understanding of these phenomena. Finally, scrapping on the surface of industrial creativity and knowledge formation shows a complexity leading us far away from the simple dichotomy between “high-tech” and “low tech”, a criterion normally based on R&D-intensity.
The conclusion is that the “footlooseness” of industrial activity is far from total; a fact which to a large extent is related to the systemic character of industrial creativity and knowledge formation. It is also argued that the breaking away from Fordism creates large potentials for utilising the slumbering creativity of the employees in maturing industries. Although these organisational and learning schemes may be classified as low-tech they may nevertheless contribute to important changes in productivity and product improvement.

Zusammenfassung

In dem vorliegenden Papier wird die gegenwärtige Diskussion in den entwicklelten Industrieländern über die zukünftige Entwicklung von Low-tech Industrien und deren Restrukturierung aufgegeriffen. Drei teilweise miteinander verschränkte Makro-Phänomene werden analysiert: der Prozeß der Globalisierung, die internationale High-tech Konkurrenz und der langfristige Wandel der Industriegesellschaft zu einer ”post-industriellen” Gesellschaft.
Die gängigen Auffassungen über den grundlegenden Charakter des strukturellen Wandels werden jedoch in drei Aspekten in Frage gestellt: aufgezeigt werden deutliche Leistungs-differenzen innerhalb der Industrie, die auf industrielle Kreativitätspotentiale auch dort hinweisen, wo man sie nicht vermutet. Innerhalb der ökonomischen Debatte zeigt sich ein wachsendes Interesse an diesen kreativen und innovativen Bestandteilen industrieller Aktivitäten und man hat Instrumente entwickelt, die diese Phänomene besser verstehen helfen. Schließlich führt die Beschäftigung mit industrieller Kreativität und der Erzeugung von Wissen sehr schnell weit über die einfache und gebräuchliche Dichotomie zwischen ”High-tech” und ”Low-tech” hinaus, die üblicherweise lediglich über den Indikator FuE-Intensität bestimmt wird.
Die Schlußfolgerung ist, daß industrielle Aktivitäten alles andere als ”footloose” sind; ein Umstand, der in hohem Maße auf den systemischen Charakter industrieller Kreativität und Wissensformierung zurückzuführen ist. Es wird argumentiert, daß gerade die Abkehr von ”fordistischen” Industriestrukturen große Potentiale für die brachliegende Kreativität der Beschäftigten in reifen Industrien schafft. Obgleich darauf zielende Organisations- und Lernmuster als low-tech klassifizierbar sind, können sie zu wichtigen Verbesserungen der Produktivität und der Produktentwicklung beitragen.

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Know-how in a low tech company - chances for being competitive in a globalized economy

Paper presented at the University of Dortmund, Faculty for Social Sciences, Chair of Technology and Society, January 26, 1999

1 Introduction

First of all I would like to thank you for inviting me to present my thoughts on *know-how in a low-tech company - chances for being competitive in a globalized economy*. I will use this opportunity to discuss the overall structural phenomena related to the theme of today rather than dig into details of my research or of others. My approach will be conjectural and preliminary. I believe a large part of the terrain is still to be discovered.

Our problem - as identified in the title of this presentation - is nourished by three partly interrelated and fundamental phenomena which nevertheless may be analytically separated:

* The globalization process
* The global high-tech competition
* The escape away from industrial activity

Consequently I will, in the second section, start my presentation with some superficial comments on these three phenomena. To summarize in advance: together these tendencies push towards an industrial restructuring focusing on "R&D intensive" service activities, i.e. leaving physical transformation (manufacturing/processing) to actors and territories supposed to be loosers or at least less advanced in the global competitive process.

I will, however, in the third section of my presentation, also on a superficial level, discuss some challenges to the conventional wisdom - of empirical as well as of theoretical character - which take us further towards our interest in so called low-tech industrial activities:

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- stylized facts of industrial activities today
- the distinction between allocative and creative analytical perspectives
- the conceptualization of creativity and knowledge formation within industry and technology, i.e. our understanding of “high-tech” and “low-tech”.

In the fourth and concluding section I will return to the core of today´s theme and knit the threads together.

2 The foundations of the ”low-tech problem”

a) The globalization process

Twenty years ago I participated in a project at the Swedish Secretariat for Futures Studies - an analytic think tank affiliated to the Swedish Government Office. We were supposed to analyse “Sweden in a New Economic World Order”.Our project developed into an analysis of long term mechanisms of structural change within the world economy. In relation to the present discussion on globalization - as illustrated by the book by Martin and Schuman (1997/98) some years ago - it seems that we were early entrants on the analytical scene. However, there were already in the mid seventies several texts available analysing the tendencies to global sourcing. Among others I was influenced by economists like Stephen Hymer (1972) and György Adam (1975). The globalization debate these years, in the late seventies when the European unemployment figures had more than doubled compared to the figures around 1970, was also influenced by the voluminous Starnberg report 1977 by Fröbel, Heinrich and Kreye on *Die Neue Internationale Arbeitsteilung.*

My first contribution to our project was a study on the role of the free trade zones in relation to the international division of labour (Laestadius, 1979). My conclusion by then was that the Starnberg way of counting free zones gave a simplified and incomplete picture of the mechanisms and magnitude of the tendencies towards a new international division of labour.

In a later report (Laestadius, 1980) I leaped a step forward and tried to capture the mechanisms behind the emerging global system of production. I tried to identify different types of comparative advantages through classifying them according to their ties to areas or actors respectively. The hypothesis was that there was a tendency towards “footloose” competencies which could be acquired by competent global actors (transnational corporations) and applied more or less all over the world. Consequently these actors could use their ability for global sourcing to arrange globally dispersed production processes of which the localization of individual segments would depend on the specific advantages obtainable through negotiations with weak institutions and governments facing severe competition from exploited labour.

There were promises and there were threats identified in these globalization

analyses from the 70ies. The rapidly industrialising countries - they were called NIC:s - in fact showed no clear tendency towards increased exploitation of labour but showed increases in wage levels and thus created new demand and new markets also for old economies and countries and thus partly balancing the threats of fierce international low wage competition. However, there was also some hope for the old industrialised countries produced on the one hand by the family of neo-technological theories on trade and international competition (cf. Vernon, 1967) and on the other hand from the theories of long term economic development. The first approach focuses on the global high tech competiton, the second on the path (supposed to be) followed by all or most countries from simple agrarian production to advanced R&D intensive activities.

Although these may be looked upon as different sides of the same coin I will now, shortly, analyse them one at a time.

b) The global high-tech competition

There was, already in the 1960ies an emerging interest in the role of science for industrial competitiveness and growth. OECD introduced several activities in this area (cf. OECD, 1971 & OECD, 1981).

To maintain or regain international competitiveness in this globalized economy many countries have joined a “high-tech race”. The strategy identified - to restructure from “low-tech” to ”high-tech” industrial activities - is on the whole connected with a restructuring from industries with low R&D-intensity to industries with high R&D-intensity (cf. Scherer, 1992; Archibugi & Pianta, 1992).

This area of data collection, statistics and analysis is to a large extent dominated by the OECD and is also a concern for the European Union. Industries and countries are compared as regards their achievements in core science and technology indicators (cf. OECD, 1994). On the input side the emphasis is on money and research time spent on R&D. On the output side the emphasis is on patents and published articles and papers.

The conclusions which may be drawn from these primarily quantitative exercises are far from obvious however. In fact the role played by Sweden and Swedish industry illustrates the difficulties to draw advanced conclusions from the available statistics (cf. Laestadius, 1996 & 1998b). Sweden is according to many indicators - e.g. total R&D expenditure as well as IT-penetration of the economy - in a leading position among OECD countries. However the economic performance is lagging behind many countries with significantly lower efforts allocated to these areas. In addition this high-tech country has a large part of its industry within areas classified as low-tech (= low R&D-intensity) like pulp and paper.[2] Swedish - and Finnish - industries

[2]Present OECD-typologi identifies four high-tech industries, six medium-high tech, eight medium low and four low-tech industries classified according to their R&D intensity (R&D expenditure as a percentage of value added) which is 17.9%; 9.8%; 1.3% and 0.5% respectively

are, however, well performing within these areas. Is this in the long run a problem for countries with ambitions to keep its top position in the high-tech race?

c) The escape from industrial activity

Probably all of us in our minds have a long term development model for society of the general form:

- agrarian economy and society,
- industrial economy and society,
- service economy and society.

This model has its origin in studies by Fischer (1939) and Clark (1940). Their idea was that as societies develop the relative importance of the sectors change from primary (agrarian) via secondary (industrial) to the tertiary (service).

As regards the third stage it has, during the recent three decades, been the subject for many research activities focusing on various aspects of its presumed character. On the level of *grand theory* there is a set of internationally well known books which have contributed to our self understanding. The analyses of the *post-industrial society* by Daniel Bell (1973), by the *post-materialist society* by Ronald Inglehart (1977) and *the Third Wave* by Alvin Toffler (1980) are well known.

Leaving the macro-sociological heights however and narrowing the focus to the concrete processes of transformation of individual economies, industries and companies, the problems of post-industrial grand theory becomes evident. This has also been noticed by many analysts (e.g. Block, 1990; Kumar, 1978 & Gershuny, 1978). Most of the problems relate to services: the concept of service (what is the character of this intangible compared to a tangible); the connection between services and the material production system; the distinction between services in the interindustry system and services for final consumption and finally the deeper understanding of the character and role of these interindustrial and final consumption services (cf. Gershuny, 1978; Gershuny & Miles, 1983; Petit, 1986 & Cohen & Zysman, 1987).

In short the growth of services in advanced industrial economies to a large extent is explained by *interindustry services*: first the phenomenon of outsourcing, i.e. the identification and isolation of supporting activities which are externalized into separate entities to make them more efficient. Second the changing character of industrial production, i.e. the growing importance of indirect and supporting activities while direct material handling and transformation is managed by technical devices. Within this area we face relative as well as absolute growth of supporting and indirect activities. Third, the knowledge base of these services are far from homogenous: floor sweeping and basic research in molecular cell biology have

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(OECD1997, pp. 109f & 131).

different implications on individual and organizational skills and competences.

The movement from primary via secondary to tertiary sectors in the economy is sometimes looked upon as a time independent process, a sequence of stages all economies have to follow in their developement. Individual corporations often also make it an explicit strategy to follow a similar path, i.e. upgrade to services. The internationally probably unknown Swedish company Segerstroem & Svensson is eg since some years ago engaged in buying many of the traditional industrial plants and processes from Ericsson, which you probably know better. However, the present strategy from Segerstroem & Svensson in its turn is to reduce its dependence on industrial activities and concentrate on services. Where, and by whom, will the Ericsson mobile phones and radio base stations in the end be manufactured?

I think these phenomena provide the foundation for our understanding of the ”low-tech problem”: the globalization, the high tech race and our efforts to leave industrial society behind us. Let us now turn to the challenges in this conventional wisdom:

3 Challenges to the conventional wisdom

a) Stylized facts of our contradictory world

Following the late Nicholas Kaldor (1985) I believe all social scientists should allow immediate and simple facts around them to influence their analysis and to prevent the theoretical constructs to loose contact with reality.

Assuming that the forces of global restructuring are very strong, dominant or even irresistable we may expect that similar actors and countries behave or position themselves relatively similar. The differences between actors and countries, which from many aspects show strong similarities, are large, however.

There are large differences in economic and industrial performance between similar high-cost countries. This may e.g. be illustrated by a comparison between Finland and Sweden. Irrespective of whether we measure the whole economy, the private sector or the knowledge, labour or capital intensive sectors we find that labour productivity has increased faster in Finland than in Sweden for nearly two decades.

The large differences between similar “low-cost” regions/countries as regards economic and industrial performance indicate that institutional and cultural factors may be at least as important as crude economic variables. There are also large differences between regions within countries with homogenous resource, cost & tax structure:

- the Gnosjö area (Småland) compared to the rest of Sweden (Berggren et.al., 1998),

- the ”Third Italy” compared to the rest of Italy (Rabelotti, 1997),
- Silicon Valley and Route 128 (Saxenian, 1994).

In addition there are large differences between industries within the same country as well as between companies within the same industry within the same country indicating the potential for large variations in performance for actors working under similar economic conditions.

Totally in line with that we can also easily find strong shifts over time within the same plant or company indicating that a change of managerial, entrepreneurial or cultural conditions may have a deep impact of productivity and competitiveness even in low-tech activities. Some years ago I participated in a research project where we analysed 16 low-tech or medium-tech plants and companies which under high competitive pressure decided to dramatically increase the mobilisation of their human capital resources. 40% of the companies increased their productivity with at least 30%, the bulk of the rest with at least 10%. In addition lead times were shortened and product quality raised (Hamngren et. al, 1995).

In short: we may cut, structure and organize the world around us in many ways to normalize for various fundamental economic variables and we will still, at every moment, find large differences in economic performance which cannot be explained by these variables. In other words, stylized facts indicate that either orthodox economic theory is wrong or - more probably - is its explanatory power shadowed by other important explanatory variables which, of course, may be either of economic or non-economic character (cf. Kaldor, 1985).

Let us now turn to these factors.

b) From an allocative perspective to a creative

Again I will allow Nicholas Kaldor to inspire the analysis. This time I will use his distinction between *allocative* and *creative* perspectives on economic processes, something which he worried about already in the thirties but which he formulated around 1972 (cf. Laestadius, 1992, chpt. 9; & Kaldor, 1978). To simplify: the basics we learn from orthodox (equilibrium) economics is that economics is concerned with the *allocation* of given resources which may be interpreted as a basically static approach. There are, however, within economic theory important traditions analysing the mechanisms behind economic change, i.e. analysing new forms of industrial organisation, the emergence of new technologies, new competences etc. This focusing on the *creative* side of economic and industrial life - i.e. *the creation of new resources* - has its origin in the writings of Marshall and Schumpeter.

In short again: here we have some of the tools for understanding the creativity of industrial processes, the observations we frequently make that new combinations, new ways of industrial organisation and new competencies on highly specialised processes and products may well create competitiveness in areas where you, from a simple factor cost analysis, would never dream of profitability.

I will not, here, go into the details. I have recently done that in another context (Laestadius, 1999). Let me just mention the phenomena with which Marshall struggled and which caused problems to the equilibrium analysis:

- externalities,
- increasing returns,
- learning.

He did not solve the theoretical problems of introducing these concepts to equilibrium theory but he gave inspiration for further research on the dynamics of industrial districts - in fact they are often "low-tech".

The contribution of Schumpeter (1911 / 1968) to this area of research was:

- a focus on the fundamentals of economic development rather than equilibrium.
- Innovations and new combinations as the means for creative destruction of old products, processes and companies.
- the role of the entrepreneur.[3]

So, summing up the arguments from a) and b), i.e. the stylized facts of the industrial world around us and approaching these facts from an creative point of view we may well ask ourselves: what is the character of this industrial creativity, how do we identify and measure it. In the next subsection we turn to this problem.

c) On the conceptualization of creativity and knowledge formation in industry and technology - the notion of high-tech or low-tech

The new interest in industrial dynamics is not without problems as regards the conceptualization of creativity and knowledge formation in industry and technology. In fact it seems too easy for academically based analysts to identify the knowledge formation process with R&D and with academia. This process is probably facilitated by the fact that many high profit and high growth industries also show high R&D-intensities. In addition R&D-data provide us economists with neat inputs for our quantitative analyses.

However, there is much research done on the relation between science, R&D, academia, industry, technology, growth, patents etc. Although there are indices that the role of science has become more important over time the general picture is complex and far from the linear model where everything starts with basic natural science and ends up with the inkjet printer (cf. Rosenberg, 1992; cf. also Laestadius, 1996 for further references).

[3]The interest for industrial creativity in orthodox economics may be checked using the "entrepreneur test" i. e. controlling the occurence of the word "entrepreneur" in the index of ordinary textbooks in economics.

Here is no time or space to analyse these problems in depth. We restrain ourselves to point to some aspects on this industrial and technical knowledge formation which do not fit to the standard understanding of R&D and thus high-tech activities:

The important role of traditional engineering. As I showed in my analysis of the competitiveness and knowledge formation of Ramnäs Anchor Chains in Sweden there is still a domain left for traditional creative engineering based on tacit knowledge, empirically based parameter variation and strong demand forming competence towards external science institutions. The demand for high quality heavy mooring chains have not decreased over time - on the contrary the quality demands also on mature products increases rather than decreases in many technological and industrial fields. Within the framework of the existing technology this creates niches for those companies and engineers which can utilise and transform general advances in other areas of technology into advanced specific technical solutions in mature areas. If these specialised competencies (cf. Porter, 1990) based on "traditional" engineering skills find a niche (in a world dominated by differentiated products) where they can develop excellence they will more than compensate for disadvantages in factor costs (Laestadius, 1995).

The high potential of educational & organisational reforms. In a study of bench-marking character we analysed 16 mainly middle tech manufacturing companies which had committed themselves to considerable educational and reorganisational schemes. In general they all faced fierce international competition. The study showed that there was an enormous potential of productivity gains, quality increases, reductions of lead times etc. primarily if organizational reforms were combined with upgrading of competencies and responsibilities for the employees (Hamngren et.al., 1995).

The systemic character of engineering, i.e. across company borders. In my analyses of technological development and industrial competence within pulp and paper technology I found that technological change to large extent is strongly systemic over company borders. The technological change within pulp and paper industry is thus integrated with developmental efforts within other industries, i.e. within a *technological system.* Standard industrial classification does not show the dynamics in technological change as the interplay between technology receiving and technology producing industries is hidden (Laestadius, 1998a).

The transformation of disembodied knowledge to embodied knowledge via project management. My research on pulp and paper industry indicates that technological development in heavy industries is concentrated to the phases of new installations when *disembodied* knowledge (e.g. "running competence") is transformed into *embodied* knowledge, i.e. built into the new equipment. This is to a large extent what investment project groups work with and is seldomly accounted for in the R&D statistics although these phases may represent the most important agglomerations of engineers in the industry or company (Laestadius, 1998a & 1998b).

The shaky registration of development activities in the accountancy. Although the

OECD has published a manual (OECD, 1993) on how to account for R&D activities it may be argued that at least mature industries do not identify their knowledge formation in a way compatible with the manual. In fact my case studies of technical change within pulp and paper industry indicates that as much as 80% of all development costs may fall outside the R&D statistics. That leaves a shaky ground for an uncritical use of R&D-data for analytical purposes (Laestadius, 1998b).

The difference between analytic and synthetic competence. The "synthetic" competence of coordinating large (socio)technical systems is obviously different from the "analytical" competence associated with many of the activities connected with science. The concept of R&D has a natural connection with the later and may create a bias against mature industries in inter-industry comparisons (cf. Patel & Pavitt, 1994).

The specificity of competence and knowledge formation. The importance of this aspect has been pointed at by Michael Porter (1990) among others. In summary his argument is that what counts is not factor costs or the availability of scientists and engineers in general but the very specialised competencies connected with certain technologies or industries.

Summing up this subsection then: creativity and knowledge formation within industry and technology may be analysed from many points of view. It is far from clear which qualities and competencies are more complex and demanding than others. The connection of high-tech and low-tech concept with R&D-intensity from this point of view seems to be somewhat arbitrary.

4 Concluding discussion

We are now rapidly approaching the end of my presentation and I have just, as we say in Sweden, circulated around the theme of today like a cat walking around a bowl of hot porridge without touching it. So let us summarise:

Although the globalization process is very strong on the financial level of the economy the change of industrial life is not so obvious. *There are limits to the footlooseness.* I think that we and others underestimated this in our analyses in the late 70ies. Qualified industrial processes, they may be science based or not, demand high levels of specific competences, often connected with long periods of learning and related to specific contexts. This introduces elements of friction in the globalization process. In a world of non-homogenous qualified products where every product necessitates specialised competencies, simple factor costs are far from the only things that count.

The industrial creativity and knowledge formation is highly systemic in character. This systemic character appears on many levels: industrial districts, professions, corporate cultures, national innovation systems, technological systems etc. This

contributes on many levels to the friction just mentioned. It may be argued that this systemic character should be considered in the formulation of technology strategies for companies - and for countries and regions:

- how are the cognitive connections between the material production proper and their supporting services? In short: can we concentrate on services, throw out manufacturing and still stay competitive in the long run?

- How are the cognitive connections between the ”low-tech” and ”high-tech” activities in a production chain? In short: can we concentrate on the R&D part of the chain and neglect the learning by doing and learning by using ends of the system?

- In other words: how narrow should the ”core competence” be defined in order not to destroy the foundations for learning and competence upgrading.

It is in addition to this far from clear that the distinction between scientific and non-scientific activities is identical with the distinction between complex and non-complex activities. Maybe we too easy commit ourselves to an antropocentric view (like Vernon, 1966) assuming that we, in the advanced industrial countries, are most competitive in complex pro-cesses and products and in addition assume that these processes and products also are those which are science based. My distinction between analytic and synthetic competencies may be useful in the search for qualified and complex engineering activitites of a non-science - and thus low-tech - character.

The strong tendencies to escape from industrial activity into services (the tertiary economy) assumed to be highly qualified are enforced by our understanding of industrial activities as dirty, manual and non-creative. This is a heritage from the past, from Fordism and Taylorism. It is still present, not only in our minds but also in industry. As shown by many organisational and educational projects in industry - in Sweden as well as in other countries - *the potential for large increases in productivity and product improvements seems considerable.* The old industry was not organized to mobilise the creativity of the workers. Today the educational level is much higher than half a century ago and human resources more available than ever. The still bad mobilization of creativity of the majority of people engaged in industrial production has in general been neglected in the science oriented discourse on the knowledge based society. A recent study within the OECD (1998) shows that the competence and creativity of people to a large extent is not utilised within working life.

Here, I believe, is the starting point for our further research on the mobilization of creativity within mature but necessary industries, normally related to material production and classified as low-tech.

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